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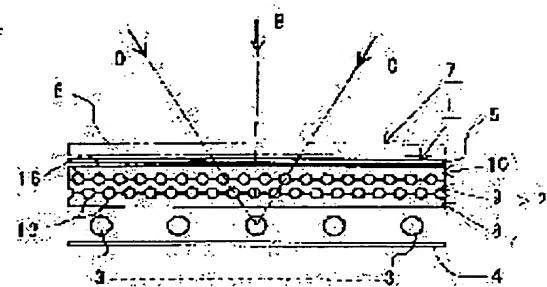
(71)Applicant : ENPLAS CORP
(72)Inventor : OSUMI KAZUMASA

(54) ASSEMBLY OF DIFFUSING MEMBER, SURFACE LIGHT SOURCE DEVICE AND IMAGE DISPLAY DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To make the illumination light uniform in the normal direction and in the oblique direction of a light exiting face.

SOLUTION: A plurality of fluorescent lamps 3 are disposed in the back face side of the assembly of a diffusing member, a reflecting member 4 is disposed below the fluorescent lamps 3, and a diffusing sheet 5 is disposed in the exiting side (upper face side) of the assembly of the diffusing member. The assembly 2 of the diffusing member has a three-layer structure including a first layer 8 to a third layer 10, each layer composed of a plurality of diffusing member blocks. A plurality of holes 13, 16 each having a circular cross section are formed on the stacking faces of the layers, while the holes 13 shifted by a half of the pitch from the holes 16.



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CLAIMS

[Claim(s)]

[Claim 1] The 1st layer which is the diffusion member assembly which diffuses and carries out outgoing radiation of the light from the light source arranged to the rear-face side, and consists of one or more diffusion member blocks, The diffusion member assembly characterized by having at least the 2nd layer which consists of one or more diffusion member blocks repeated in this 1st layer, and coming to form many crevices at least in one side of the superposition side of said 1st layer and said 2nd layer.

[Claim 2] The 1st layer which is the diffusion member assembly which diffuses and carries out outgoing radiation of the light from the light source arranged to the rear-face side, and consists of one or more diffusion member blocks, The 2nd layer which consists of one or more diffusion member blocks repeated in this 1st layer, The diffusion member assembly characterized by having even if few, forming many 1st crevice in the field which counters said 2nd layer of said 1st layer, and coming to form many 2nd crevice which is located between said 1st crevice in the field which counters said 1st layer of said 2nd layer.

[Claim 3] The diffusion member assembly according to claim 1 or 2 which makes it the description as the diffusion member block which constitutes said 1st layer, and the diffusion member block which constitutes said 2nd layer are formed in different magnitude and the comparison location of each diffusion member block of said 1st layer and the comparison location of each diffusion member block of said 2nd layer stop lapping.

[Claim 4] The 1st layer which is the diffusion member assembly which diffuses and carries out outgoing radiation of the light from the light source arranged to the rear-face side, and consists of one or more diffusion member blocks, The 2nd layer which consists of one or more diffusion member blocks repeated in this 1st layer, While having at least the 3rd layer which consists of one or more diffusion member blocks repeated in this 2nd layer and forming many 1st crevice at least in one side of the superposition side of said 1st layer and said 2nd layer The diffusion member assembly characterized by arranging and becoming so that many 2nd crevice may be formed at least in one side of the superposition side of said 2nd layer and said 3rd layer and said 2nd crevice may be located between said 1st crevice.

[Claim 5] The 1st layer which is the diffusion member assembly which diffuses and carries out outgoing radiation of the light from the light source arranged to the rear-face side, and consists of one or more diffusion member blocks, The 2nd layer which consists of one or more diffusion member blocks repeated in this 1st layer, In the field which has at least the 3rd layer which consists of one or more diffusion member blocks repeated in this 2nd layer, and counters said 2nd layer of said 1st layer Are the field which forms many 1st crevice of a cross-section abbreviation hemicycle, and counters said 1st layer of said 2nd layer, and in the location corresponding to said 1st crevice In the field which forms the 2nd crevice of a cross-section abbreviation hemicycle, and counters said 3rd layer of said 2nd layer The diffusion member assembly characterized by forming the 3rd crevice of a cross-section abbreviation hemicycle so that it may be located between said 2nd crevice, being the field which counters said 2nd layer of said 3rd layer, and coming to form the 4th crevice of a cross-section abbreviation hemicycle in the location corresponding to said 3rd crevice.

[Claim 6] The diffusion member block which constitutes said 1st layer, and the diffusion member block which constitutes said 2nd layer are formed in different magnitude. It is made for the comparison location of each diffusion member block of said 1st layer and the comparison location of each diffusion member block of said 2nd layer not to lap. The diffusion member block which constitutes said 2nd layer, and the diffusion member block which constitutes said 3rd layer are formed in different magnitude. The diffusion member assembly according to claim 4 or 5 which makes it the description as the comparison location of each diffusion member block of said 2nd layer and the comparison location of each diffusion member block of said 3rd layer stop lapping.

[Claim 7] The diffusion member assembly according to claim 1 to 6 which uses said light source as a rod-like fluorescent lamp, and is characterized by coming to form said crevice in a line along with the longitudinal direction of said fluorescent lamp.

[Claim 8] The diffusion member assembly according to claim 1 to 7 characterized by coming to fill up said all crevices the light transmission nature matter of a different refractive index from said diffusion member block.

[Claim 9] The diffusion member assembly according to claim 1 to 7 characterized by coming to fill up the light transmission nature matter of a different refractive index from said diffusion member block to a part of crevice of said large number.

[Claim 10] Surface light source equipment characterized by having been located in the rear-face side of said diffusion member assembly according to claim 1 to 9 and this diffusion member assembly, and having the reflective member which reflects the light from said light source in the rear-face side of said diffusion member assembly.

[Claim 11] Surface light source equipment according to claim 10 characterized by coming to arrange the diffusion sheet of at least one sheet to the outgoing radiation side side of said diffusion member assembly.

[Claim 12] The image display device characterized by having surface light source equipment according to claim 10 or 11 and the image display section illuminated by this surface light source equipment.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the technique which arranges the light source to the tooth-back side of the diffusion member assembly which constitutes this surface light source equipment especially about the surface light source equipment which illuminates the image display sections, such as various image display devices, such as a liquid crystal television, a liquid crystal display monitor, car navigation equipment, and an advertising display, and these liquid crystal display panels, in the shape of a field from that rear-face side.

[0002]

[Description of the Prior Art] For example, the surface light source equipment 30 which illuminates the liquid crystal display panel of a liquid crystal display monitor as shown in drawing 11 from a rear-face side arranges two or more fluorescent lamps 32, diffuses the light from this fluorescent lamp 32 with the diffusion plate 31, and it carries out outgoing radiation to the rear-face side of the diffusion plate 31 as field-like illumination light.

[0003] However, such surface light source equipment 30 was [right above / of a fluorescent lamp 32] the brightest, and the interstitial segment of fluorescent lamps 32 and 32 became the darkest, and had the problem that light and darkness (brightness unevenness) arose from the diffusion plate 31 in the light by which outgoing radiation is carried out to the shape of a field.

[0004] Then, in order to, equalize the light from a fluorescent lamp 32 if possible and to carry out outgoing radiation from the diffusion plate 31 conventionally, a light-shielding film (protection-from-light pattern) 33 is formed in the part which is the rear-face side of the diffusion plate 31, and counters a fluorescent lamp 32, the outgoing radiation light from the right above part of a fluorescent lamp 32 is stopped, and the outgoing radiation of the light from between a fluorescent lamp 32 and 32 is urged.

[0005]

[Problem(s) to be Solved by the Invention] However, when it sees from the direction of slanting to the direction of a normal of the outgoing radiation side of the diffusion plate 31 of what can equalize the brightness of the outgoing radiation light to the direction of a normal of the outgoing radiation side of the diffusion plate 31, a light-shielding film 33 is not located between an observation location and a fluorescent lamp 32, but outgoing radiation

of such conventional surface light source equipment 30 is carried out from the diffusion plate 31, without shading the light from a fluorescent lamp 32 by the light-shielding film 33. Consequently, when it saw from the direction of slanting to the direction of a normal of the outgoing radiation side of the diffusion plate 31, it had the problem that the difference of the light and darkness of outgoing radiation light was emphasized, and lighting quality deteriorated.

[0006] Then, this invention aims at offering surface light source equipment equipped with the diffusion member assembly which can equalize the illumination light to the direction of a normal and the direction of slant of an outgoing radiation side, and this diffusion member assembly, and the image display device equipped with this surface light source equipment.

[0007]

[Means for Solving the Problem] The 1st layer which invention of claim 1 is a diffusion member assembly which diffuses and carries out outgoing radiation of the light from the light source arranged to the rear-face side, and consists of one or more diffusion member blocks, It has at least the 2nd layer which consists of one or more diffusion member blocks repeated in this 1st layer, and is characterized by coming to form many crevices at least in one side of the superposition side of said 1st layer and said 2nd layer.

[0008] The 1st layer which invention of claim 2 is a diffusion member assembly which diffuses and carries out outgoing radiation of the light from the light source arranged to the rear-face side, and consists of one or more diffusion member blocks, The 2nd layer which consists of one or more diffusion member blocks repeated in this 1st layer, It is characterized by having, even if few, forming many 1st crevice in the field which counters said 2nd layer of said 1st layer, and coming to form many 2nd crevices which is located between said 1st crevice in the field which counters said 1st layer of said 2nd layer.

[0009] Invention of claim 3 forms in different magnitude the diffusion member block which constitutes said 1st layer, and the diffusion member block which constitute said 2nd layer, and it makes it the description in claim 1 or invention of 2, as the comparison location of each diffusion member block of said 1st layer and the comparison location of each diffusion member block of said 2nd layer stop lapping.

[0010] The 1st layer which invention of claim 4 is a diffusion member assembly which diffuses and carries out outgoing radiation of the light from the light source arranged to the rear-face side, and consists of one or more diffusion member blocks, The 2nd layer which consists of one or more diffusion member blocks repeated in this 1st layer, While having at least the 3rd layer which consists of one or more diffusion member blocks repeated in this 2nd layer and forming many 1st crevices at least in one side of the superposition side of said 1st layer and said 2nd layer Many 2nd crevices is formed at least in one side of the superposition side of said 2nd layer and said 3rd layer, and it is characterized by arranging and becoming so that said 2nd crevices may be located between said 1st crevices.

[0011] Invention of claim 5 is the diffusion member assembly which diffuses and carries out outgoing radiation of the light from the light source arranged to the rear-face side, and has at least the 1st layer which consists of one or more diffusion member blocks, the 2nd layer which consist of one or more diffusion member blocks repeated in this 1st layer, and the 3rd layer which consist of one or more diffusion member blocks repeated in this 2nd layer. And many 1st crevices of a cross-section abbreviation hemicycle is formed in the field which counters said 2nd layer of said 1st layer. Moreover, it is the field which counters said 1st layer of said 2nd layer, and the 2nd crevices of a cross-section abbreviation hemicycle is formed in the field which counters said 3rd layer of said 2nd layer so that it may be located between said 2nd crevices. And it is the field which counters said 2nd layer of said 3rd layer, and the 4th crevices of a cross-section abbreviation hemicycle is formed in the location corresponding to said 3rd crevices.

[0012] Invention of claim 6 forms in different magnitude the diffusion member block which constitutes said 1st layer, and the diffusion member block which constitutes said 2nd layer in claim 4 or invention of 5, and it is made for the comparison location of each diffusion member block of said 1st layer and the comparison location of each diffusion member block of said 2nd layer to have not lapped. Moreover, this invention forms in different magnitude the diffusion member block which constitutes said 2nd layer, and the diffusion member block which constitutes said 3rd layer, and it is made for the comparison location of each diffusion member block of said 2nd layer and the comparison location of each diffusion member block of said 3rd layer to have not lapped.

[0013] In one diffusion member assembly of claims 1-6, invention of claim 7 uses said light source as a rod-like fluorescent lamp, and is characterized by coming to form said crevices in a line along with the longitudinal direction of said fluorescent lamp.

[0014] Invention of claim 8 is characterized by coming to fill up the light transmission nature matter of a refractive index which is different from said diffusion member block in said all crevices in one diffusion member assembly of claims 1-7.

[0015] Invention of claim 9 is characterized by coming to fill up the light transmission nature matter of a refractive index which is different from said diffusion member block in a part of crevice of said large number in one diffusion member assembly of claims 1-7.

[0016] The surface light source equipment concerning invention of claim 10 is characterized by having been located in the rear-face side of a diffusion member assembly according to claim 1 to 9 and this diffusion member assembly, and having the reflective member which reflects the light from said light source in the rear-face side of said diffusion member assembly.

[0017] Invention of claim 11 is characterized by coming to arrange the diffusion sheet of at least one sheet to the outgoing radiation side side of said diffusion member assembly in the surface light source equipment concerning claim 10.

[0018] The image display device concerning invention of claim 12 is characterized by having surface light source equipment according to claim 10 or 11 and the image display section illuminated by this surface light source equipment.

[0019]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained in full detail based on a drawing.

[0020] [Gestalt of the 1st operation] drawing 1 is the appearance perspective view of the surface light source equipment concerning the gestalt of operation of this invention. Moreover, drawing 2 is the decomposition perspective view of the surface light source equipment of drawing 1. Moreover, drawing 4 is a sectional view cut and shown along with the A-A line of drawing 1.

[0021] (Outline configuration of surface light source equipment and an image display device) As shown in these drawings, the surface light source equipment 1 concerning the gestalt of this operation arranges the fluorescent lamp (light source) 3 of the shape of two or more rod at the predetermined spacing to the rear-face side (the drawing 1 and drawing 2 side and inferior-surface-of-tongue side of drawing 4) of the diffusion member assembly 2, and arranges the reflective member 4 to the lower part side of those fluorescent lamps 3. This reflective member 4 reflects the light from a fluorescent lamp 3 in the rear-face side of the diffusion member assembly 2. And the diffusion sheet 5 is arranged to the outgoing radiation side side (upper part side) of the diffusion member assembly 2, and the light which carried out outgoing radiation from the diffusion member assembly 2 is diffused with the diffusion sheet 5. In addition, as shown in drawing 4, the image display device 7 illuminated with the light of the shape of a field which carried out outgoing radiation of the liquid crystal display panel 6 from surface light source equipment 1 is constituted by arranging the liquid crystal display panel (image display section) 6 in piles on the diffusion sheet 5 of surface light source equipment 1.

[0022] (Diffusion member assembly) A diffusion member assembly is a three-tiered structure from the 1st layer 8 to the 3rd layer 10. Among these, the 1st layer 8 is formed in square tabular [which corresponds to the flat-surface configuration of the liquid crystal display panel 6] by combining six diffusion member blocks 8a-8f which are square plates, as shown in drawing 3. That is, the 1st layer 8 arranges two diffusion member blocks 8a-8f perpendicularly, and arranges them three pieces horizontally (a total of two-line three trains [six] should be located in a line), and is formed in square tabular by making close an each diffusion member blocks [8a-8f] side face.

[0023] Moreover, the 2nd layer 9 is formed in square tabular [which corresponds to the flat-surface configuration of the liquid crystal display panel 6] by combining 15 diffusion member blocks 9a-9o which are square plates, as shown in drawing 3. That is, the 2nd layer 9 arranges three diffusion member blocks 9a-9o perpendicularly, and arranges them five pieces horizontally (a total of three-line five trains [15] should be located in a line), and is formed in square tabular by making close the side face of each diffusion member blocks 9a-9o. And the comparison location of each diffusion member blocks 9a-9o of this 2nd layer 9 laps with an each diffusion member blocks [of the 1st layer 8 / 8a-8f] comparison location.

[0024] Moreover, the 3rd layer 10 is formed in square tabular [which corresponds to the flat-surface configuration of the liquid crystal display panel 6] by combining two diffusion member blocks 10a and 10b which are square plates. Namely, the 3rd layer 10 arranges two diffusion member blocks 10a and 10b horizontally, and has formed them in square tabular by making close the side face of both diffusion member blocks 10a and 10b. And the

comparison location of both diffusion member blocks 10a and 10b of this 3rd layer 10 laps with the comparison location of each diffusion member blocks 9a-9b of the 2nd layer 9.

[0025] Here, each diffusion member blocks 8a-8f of each class from the 1st layer 8 to the 3rd layer 10, 9a-9b, and 10a-10b are formed in the desired configuration by carrying out injection molding of acrylic resin (PMMA) excellent in light transmission nature, a polycarbonate (PC), cycloolefin system resin, etc.

[0026] Drawing 5 is the partial enlarged drawing of the diffusion member assembly 2 shown in drawing 4. Moreover, drawing 6 is the partial enlarged drawing in which decomposing into each class from the 1st layer 8 to the 3rd layer 10, and showing the diffusion member assembly 2 shown in drawing 5.

[0027] As shown in these drawings, cross-section abbreviation hemicycle-like many 1st crevice 11 is formed in the field which counters the diffusion member blocks 9a-9b of the 2nd diffusion member blocks [of the 1st layer 8 / 8a-8f] layer 9 at equal intervals. Moreover, many 2nd crevice 12 of the cross-section abbreviation hemicycle which counters the 1st crevice 11 of the 1st layer 8 is formed in the field which counters the diffusion member blocks 8a-8f of the 1st layer 8 of the diffusion member blocks 9a-9b of the 2nd layer 9 at equal intervals. Consequently, if the diffusion member blocks 8a-8f of the 1st layer 8 and the diffusion member blocks 9a-9b of the 2nd layer 9 are stuck in piles, the hole section 13 of a cross-section approximate circle form will be formed of the 1st crevice 11 and 2nd crevice 12.

[0028] A large number are formed in the field which counters the diffusion member blocks 10a and 10b of the 3rd layer 10 of the diffusion member blocks 9a-9b of the 2nd layer 9 in the same pitch P as the formation pitch of the 2nd crevice 12 so that the 3rd crevice 14 of a cross-section abbreviation hemicycle may be located between said 2nd crevice 12. Moreover, many 4th crevice 15 of the cross-section abbreviation hemicycle which counters the 3rd crevice 14 of the 2nd layer 9 is formed in the field which counters the diffusion member blocks 9a-9b of the 2nd layer 9 of the diffusion member blocks 10a and 10b of the 3rd layer 10 at equal intervals. Consequently, if the diffusion member blocks 9a-9b of the 2nd layer 9 and the diffusion member blocks 10a and 10b of the 3rd layer 10 are stuck in piles, the hole section 16 of a cross-section approximate circle form will be formed of the 3rd crevice 14 and 4th crevice 15. In addition, when the radius of crevices 11, 12, 14, and 15 is set to R, as for each crevices 11, 12, and 14 and the pitch P between 15, determining in the range of $2R \leq P \leq 4R$ is desirable.

[0029] The case where it sees from the upper part of the diffusion member assembly 2 here (from [of drawing 4] B), When it sees from across (C of drawing 4, the direction of D), the hole section 16 made in the superposition side of the 2nd layer 9 and the 3rd layer 10 is located between the hole sections 13 made in the superposition side of the 1st layer 8 and the 2nd layer 9 (if it puts in another way). The hole section 16 is half-pitch gap ***** to the hole section 13. And as for this diffusion member assembly 2, air exists in the hole section 13 and 16. a diffusion member block (8a ... 10b) and the hole sections 13 and 16 — the rate of optical refraction — large — differing (for example, the refractive index of PMMA being about 1.49 and the refractive index of PC being 1.59) — Since the cross-section configuration of the hole sections 13 and 16 is an approximate circle form, in case the light from a fluorescent lamp 3 penetrates the diffusion member assembly 2, it is effectively spread in the hole sections 13 and 16. That is, since the light from a fluorescent lamp 3 has diffused in homogeneity in the hole sections 13 and 16 when the diffusion member assembly 2 is seen from the upper part (the direction of B of drawing 4) and it sees [not to mention] from the slanting upper part (C of drawing 4, the direction of D), the brightness of outgoing radiation light equalizes and it is hard to produce the difference of the light and darkness of outgoing radiation light.

[0030] In addition, in the gestalt of this operation, when pasting up the diffusion member blocks (8a-8f, 9a-9b, 10a-10b) which each class adjoins and unifying, it is desirable for a diffusion member block (8a ... 10b) and a refractive index to use the almost same adhesives (for example, epoxy resin adhesive).

[0031] (Reflective member) As shown in drawing 1 – drawing 2, and drawing 4, the reflective member 4 is formed in the inside of metal plates, such as resin ingredients, such as polyethylene terephthalate (PET) of the white excellent in light reflex nature, or a stainless steel plate, by the thing in which the silver vacuum evaporationo layer was formed etc., and reflects the light from a fluorescent lamp 3 to the rear-face side of the light guide plate assembly 2 effectively.

[0032] (Diffusion sheet) As shown in drawing 1 – drawing 2, and drawing 4, the diffusion sheet 5 carries out surface roughening of the front faces, such as a PET sheet excellent in light transmission nature, forms an optical diffusion pattern in the front face in the ink which has optical diffusibility, and makes the interior contain an optical diffusate, and diffuses effectively the light which carries out outgoing radiation from the diffusion member assembly 2. Consequently, when surface light source equipment 1 is seen [of the diffusion sheet 5] from an outgoing radiation side, the comparison section (division section from the 1st layer 8 to the 3rd layer 10) of a diffusion member block (8a-8f, 9a-9b, 10a-10b) of each class from the 1st layer 8 to the 3rd layer 10 stops being able to be conspicuous easily.

[0033] (An operation and effectiveness of the gestalt of this operation) The surface light source equipment 1 concerning the gestalt of these above operations If it is reflected by the direct or reflective member 4 and the light of a fluorescent lamp 3 carries out incidence from the diffusion member block 8a-8f inferior surface of tongue of the 1st layer 8 of the diffusion member assembly 2 A refraction operation is received by the interface with the crevices 11 and 12 (hole section 13) formed in the superposition side of the 1st layer 8 and the 2nd layer 9 in the process in which the incident light spreads the inside of diffusion member block 8a-8f of the 1st layer 8. Here, the cross-section configuration of the hole section 13 is an approximate circle form configuration, and since air exists in the interior of the hole section 13 and the rate of optical refraction of the interior of the hole section 13 and the diffusion member blocks 8a-9b of the 1st and 2nd layers 8 and 9 is moreover greatly different from it, the light which spreads the inside of diffusion member block 8a-8f of the 1st layer 8 diffuses in homogeneity.

[0034] And if the light which is not diffused in the hole section 13 formed in the superposition side of the 1st above-mentioned layer 8 and the 2nd layer 9 and the diffused light spread the inside of diffusion member block 9a – 9b of the 2nd layer 9 A refraction operation is received by the interface with the crevices 14 and 15 (hole section 16) formed in the superposition side of the 2nd layer 9 and the 3rd layer 10. Here, since the hole section 16 formed in the superposition side of this 2nd layer 9 and the 3rd layer 10 is the same as that of the hole section 13 formed between the 1st above-mentioned layer 8 and the 2nd layer 9, the light which spreads the inside of the 2nd layer 9 diffuses it in homogeneity in that hole section 16. That is, the hole section 16 formed in the superposition side of the 2nd layer 9 and the 3rd layer 10 can diffuse the light which was not able to be diffused in the hole section 13 formed in the superposition side of the 1st layer 8 and the 2nd layer 9. In addition, the typical optical path of the light which receives and diffuses a refraction operation in an interface with the hole sections 13 and 16 in drawing 10 is shown notionally.

[0035] Therefore, the outgoing radiation light from the diffusion member assembly 2 is equalized also in the direction of slanting (C of drawing 4, the direction of D) to the direction of a normal not to mention the direction of a normal of an outgoing radiation side (the direction of B of drawing 4). That is, in the surface light source equipment 1 of the gestalt of this operation, lighting quality of outgoing radiation light from the diffusion member assembly 2 improves so that brightness unevenness may not arise according to the observation direction.

[0036] And the light which carried out outgoing radiation from the diffusion member assembly 2 passes the diffusion sheet 5, and is used as illumination light of the liquid crystal display panel 6. Although abnormality luminescence of the stripe-like bright line occurring may be observed when the diffusion member block with which each class adjoins each other cannot fully be stuck here and an optical interface exists along the boundary Abnormality luminescence produced in the each diffusion member blocks [of the 1st layer 8 / 8a-8f] comparison section diffuses with the 2nd layer 9, 3rd layer 10, and diffusion sheet 5. Abnormality luminescence produced in the comparison section of each diffusion member blocks 9a-9b of the 2nd layer 9 diffuses with the 3rd layer 10 and diffusion sheet 5. abnormality luminescence produced in the comparison section of diffusion member block 10a of the 3rd layer 10 and 10b diffuses with the diffusion sheet 5 — having — each diffusion member block 8a ... abnormality luminescence produced in the comparison section of 10b stops being conspicuous Consequently, the surface light source equipment 1 concerning the gestalt of this operation can illuminate the liquid crystal display panel 6 with a bright uniform light, and the display of the liquid crystal display panel 6 becomes legible.

[0037] Moreover, since the surface light source equipment 1 concerning the gestalt of this operation does not need to form a light-shielding film (protection-from-light pattern) like the conventional example, it can raise whenever [outgoing radiation luminosity] so that light may not be absorbed by the light-shielding film.

[0038] Moreover, since the surface light source equipment 1 concerning the gestalt of this operation multilayers the diffusion member assembly 2 in the 1st – the 3rd layer 8-10, divides each class 8-10 into two or more diffusion member blocks 8a-8f, 9a-9b, and 10a-10b and is constituted, Small diffusion member block 8a ... By making [many] the combination number of 10b, the exit light surface product of the diffusion member assembly 2 can

be enlarged easily, therefore — according to the gestalt of this operation — diffusion member block 8a ... while the metal mold for carrying out injection molding of the 10b, is small and ends — the magnitude (magnitude of a display screen) of the liquid crystal display panel 6 — not being concerned — diffusion member block 8a ... injection molding of 10b — public funds — it becomes possible to manufacture easily the surface light source equipment 1 for large-sized screens, without enlarging a manufacturing facility, since a mold can be shared.

[0039] Moreover, since the inside of the hole section 13 of the diffusion member assembly 2 and 16 is an air space, the surface light source equipment 1 concerning the gestalt of this operation can attain lightweight-ization of whole weight.

[0040] moreover, diffusion member block 8a of plurality [assembly / 2 / concerning the gestalt of this operation / diffusion member / each class / 8-10] ... it divides into 10b — having — **** — each diffusion member block 8a ... in order that 10b may be small and may tend to carry out injection molding, it is hard to produce poor shaping and the rate of the yield of a product is good.

[0041] [Gestalt of the 2nd operation] drawing 7 is the side elevation expanding and showing some diffusion member assemblies 2 concerning the gestalt of operation of the 2nd of this invention.

[0042] As shown in drawing 7 , the gestalt of this operation forms many 1st crevice 20 of a cross-section abbreviation hemicycle in either of the superposition sides of the 1st layer 8 and the 2nd layer 9, and forms many 2nd crevice 21 of a cross-section abbreviation hemicycle in either of the superposition sides of the 2nd layer 9 and the 3rd layer 10. In addition, each class of the 1st layer 8 to the 3rd layer 10 is two or more diffusion member block 8a like the gestalt of the 1st operation of the above-mentioned... It is constituted combining 10b (refer to drawing 3).

[0043] Namely, the 1st example of the gestalt of this operation forms the 1st crevice 20 in the field which counters the 2nd layer 9 of the 1st layer 8, as shown in drawing 7 (a). The 2nd crevice 21 is formed in the field which counters the 2nd layer 9 of the 3rd layer 10, and, moreover, the 2nd crevice 21 is located between the 1st crevice 20 and 20 (if it puts in another way, the 2nd crevice 21 will be half-pitch gap ***** to the 1st crevice 20).

[0044] Moreover, the 2nd example of the gestalt of this operation forms the 1st crevice 20 in the field which counters the 1st layer 8 of the 2nd layer 9, as shown in drawing 7 (b). The 2nd crevice 21 is formed in the field which counters the 3rd layer 10 of the 2nd layer 9, and, moreover, the 2nd crevice 21 is located between the 1st crevice 20 and 20.

[0045] Moreover, the 3rd example of the gestalt of this operation forms the 1st crevice 20 in the field which counters the 1st layer 8 of the 2nd layer 9, as shown in drawing 7 (c). The 2nd crevice 21 is formed in the field which counters the 2nd layer 9 of the 3rd layer 10, and, moreover, the 2nd crevice 21 is located between the 1st crevice 20 and 20.

[0046] Moreover, the 4th example of the gestalt of this operation forms the 1st crevice 20 in the field which counters the 2nd layer 9 of the 1st layer 8, as shown in drawing 7 (d). The 2nd crevice 21 is formed in the field which counters the 3rd layer 10 of the 2nd layer 9, and, moreover, the 2nd crevice 21 is located between the 1st crevice 20 and 20.

[0047] Also in the gestalt of this implementation of such a configuration, since the light from a fluorescent lamp 3 can be diffused by each crevices 20 and 21 and outgoing radiation of the light can be carried out to homogeneity from the outgoing radiation side of the diffusion member assembly 2, generating of the brightness unevenness of the outgoing radiation light by the observation direction can be prevented effectively.

[0048] Moreover, also in the gestalt of this operation, the same effectiveness as the gestalt of the 1st operation of the above-mentioned can be acquired.

[0049] [Gestalt of the 3rd operation] drawing 8 is the side elevation expanding and showing some diffusion member assemblies 2 concerning the gestalt of operation of the 3rd of this invention.

[0050] The gestalt of this operation constitutes the diffusion member assembly 2 from the 1st layer 8 and 2nd layer 9, and forms many crevices 22 at least in one side of the superposition side of these 1st layers 8 and the 2nd layer 9. In addition, the 1st layer 8 and 2nd layer 9 of a gestalt of this operation are constituted combining two or more diffusion member blocks 8a-8f, and 9a-9o like the gestalt of each above-mentioned operation.

[0051] That is, as shown in drawing 8 (a), the 1st example of the gestalt of this operation makes crevices 22 and 22 counter the superposition side of the 1st layer 8 and the 2nd layer 9, and is formed in it. Moreover, the 2nd example forms many crevices 22 in the field which counters the 2nd layer 9 of the 1st layer 8, as shown in drawing 8 (b). Moreover, the 3rd example forms many crevices 22 in the field which counters the 1st layer 8 of the 2nd layer 9, as shown in drawing 8 (c). in addition, these the 1- the crevice 22 of the 3rd example is continuously formed by the smooth curve, and an adjacent crevice 22 and no less than 22 adjacent comrades are also connected by the smooth curve. Therefore, the cross-section configuration of the field which forms a crevice 22 is presenting the abbreviation wave configuration.

[0052] Moreover, the 4th example forms many crevices 22 and 22 of a cross-section abbreviation hemicycle in each superposition side of the 1st layer 8 and the 2nd layer 9, respectively, as shown in drawing 8 (d), and the crevice 22 of the 2nd layer 9 is located between the crevice 22 of the 1st layer 8, and 22.

[0053] The diffusion member assembly 2 concerning the gestalt of such this operation can also diffuse the light from a fluorescent lamp in a crevice 22, and can prevent generating of the brightness unevenness by the observation direction effectively.

[0054] In addition, since the diffusion member assembly 2 concerning the gestalt of this operation has few layers, thin-shape-izing and lightweight-ization of the image display device 7 equipped with surface light source equipment 1 and this surface light source equipment 1 can be attained.

[0055] Although the mode to which air exists in crevices 11-12, 14-15, and 20-22 is illustrated, it is not restricted to this, but the gestalt of each [other modification] above-mentioned operation is diffusion member block 8a in crevices 11-12, 14-15, and 20-22... You may make it filled up with the light transmission nature matter of the refractive index of 10b, and a different refractive index. Moreover, crevices 11-12, 14-15, and the light transmission nature matter with which 20-22 are filled up are diffusion member block 8a... Mixing distribution of the minute particle which has a refractive index which is different from this into 10b, congenital, or an ingredient of a different kind may be carried out. In addition, all of crevices 11-12, 14-15, and 20-22 may be filled up with the light transmission nature matter, and you may make it fill up the part with it.

[0056] Moreover, in the gestalt of each above-mentioned operation, although the crevices 11-12 of the cross-section configuration continuously formed by the abbreviation hemicycle or the smooth curve, 14-15, and 20-22 were illustrated, the crevice of a cross-section abbreviation triangle and the crevice of other cross-section configurations are [that what is necessary is just the crevice of the cross-section configuration which is not restricted to this but can diffuse light] sufficient.

[0057] Moreover, although the gestalt of each above-mentioned operation has illustrated the mode which constitutes the diffusion member assembly 2 from three layers or two-layer, it is not restricted to this but may use the diffusion member assembly 2 as the multilayer-structure object of four or more layers.

[0058] Moreover, although the gestalt of each above-mentioned operation illustrates crevices 11-12, 14-15, and the mode that forms 20-22 in a line along with the longitudinal direction of a fluorescent lamp as shown in drawing 9 , it may be made into the mode which is not restricted to this, for example, forms many crevices in the shape of a dot.

[0059] Moreover, although the formation pitch of a crevice (hole section) is made fixed with the gestalt of each above-mentioned operation, you may make it change the roughness and fineness of the formation pitch according to a relative location with the light source arranged to a rear-face side.

[0060]

[Effect of the Invention] As mentioned above, since the diffusion member assembly which this invention diffuses the light from the light source arranged to the rear-face side, and carries out outgoing radiation can diffuse light in homogeneity in the crevice which is a multilayer-structure object and was formed at least in one side of the superposition side of each class, According to the observation direction, it can stop effectively that brightness unevenness arises, and not to mention the direction of a normal of an outgoing radiation side, the luminance distribution of the outgoing radiation light to the direction of slanting can also be equalized to the direction of a normal of an outgoing radiation side, and improvement in lighting quality can be aimed at.

[0061] Moreover, since the crevice which formed this invention at least in one side of the superposition side of each class of a diffusion member assembly diffuses light, it is not necessary to form a protection-from-light pattern like the conventional example in a diffusion member, and only the part which does not have the absorption of light by the protection-from-light pattern at least can raise whenever [outgoing radiation luminosity].

[0062] Therefore, surface light source equipment equipped with the diffusion member assembly concerning this invention is formed into high brightness while the illumination light which illuminates the image display section equalizes. Consequently, the image display device equipped with such

[Translation done.]

* NOTICES *

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the appearance perspective view of the surface light source equipment concerning the gestalt of operation of the 1st of this invention.

[Drawing 2] It is the perspective view disassembling and showing the surface light source equipment of drawing 1.

[Drawing 3] It is the top view disassembling and showing the diffusion member assembly concerning the gestalt of operation of the 1st of this invention.

[Drawing 4] It is the sectional view cut and shown along with the A-A line of drawing 1.

[Drawing 5] It is the partial enlarged drawing of the diffusion member assembly shown in drawing 4.

[Drawing 6] It is the partial enlarged drawing disassembling and showing the diffusion member assembly shown in drawing 5.

[Drawing 7] It is the partial enlarged drawing of the diffusion member assembly concerning the gestalt of operation of the 2nd of this invention.

[Drawing 8] It is the partial enlarged drawing of the diffusion member assembly concerning the gestalt of operation of the 3rd of this invention.

[Drawing 9] It is the perspective view showing the configuration of the crevice formed in each class of a diffusion member assembly.

[Drawing 10] It is drawing showing notionally the typical optical path of the light diffused in response to a refraction operation in an interface with the hole section.

[Drawing 11] It is the side elevation expanding and showing some conventional surface light source equipments.

[Description of Notations]

1 Surface light source equipment, 2 .. A diffusion member assembly, 3 .. Fluorescent lamp (light source), 4 A reflective member, 5 .. A diffusion sheet, 6 .. Liquid crystal display panel (image display section), 7 [.. The 3rd layer, 8a-8f, 9a-9o, 10a-10b / .. A diffusion member block, 11, 12, 14, 15, 20, 21, 22 / .. Crevice] An image display device, 8 .. The 1st layer, 9 .. The 2nd layer, 10

[Translation done.]

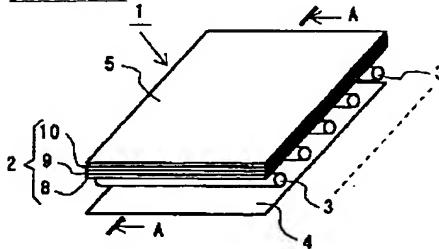
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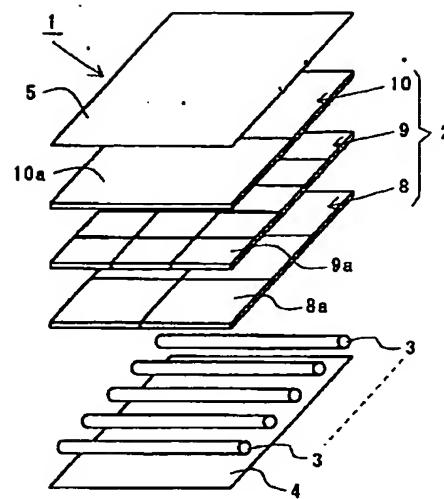
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DRAWINGS

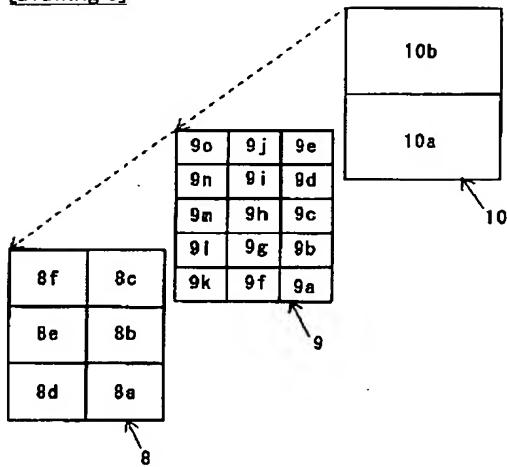
[Drawing 1]



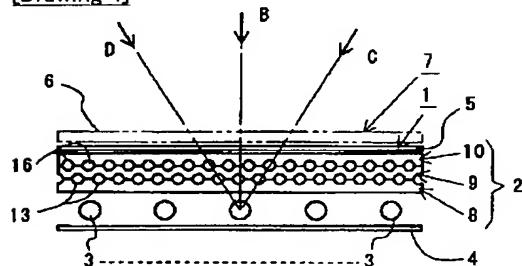
[Drawing 2]



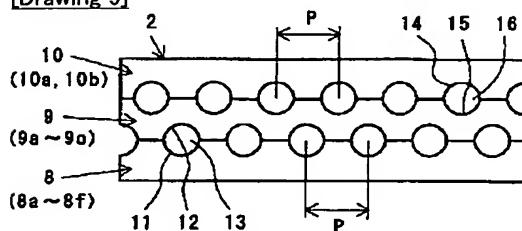
[Drawing 3]



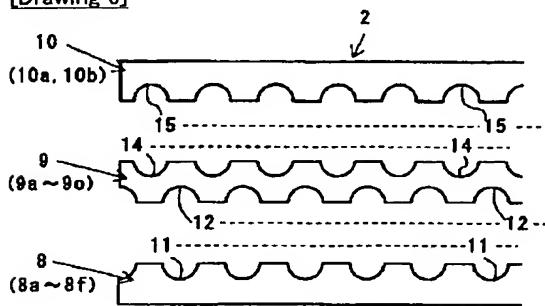
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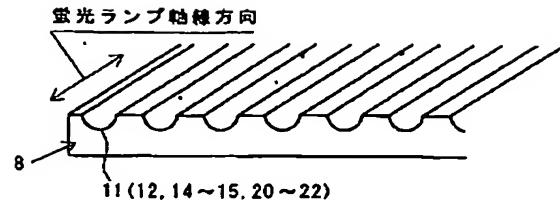
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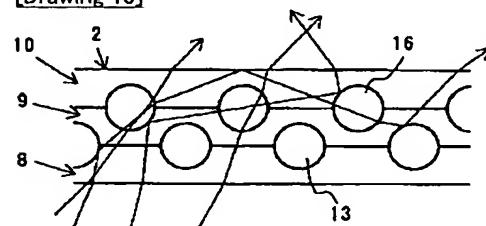
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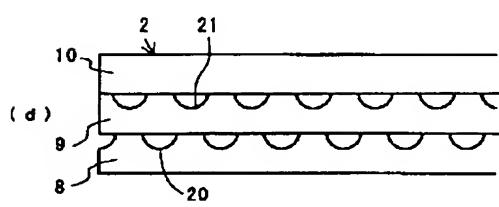
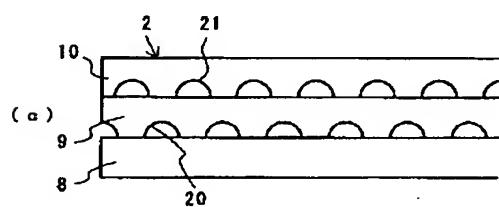
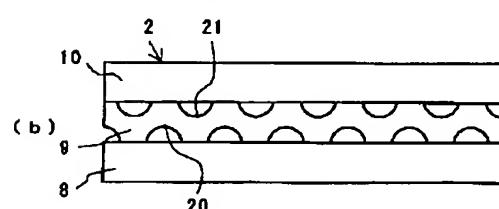
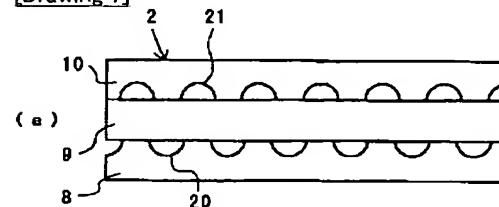
[Drawing 9]



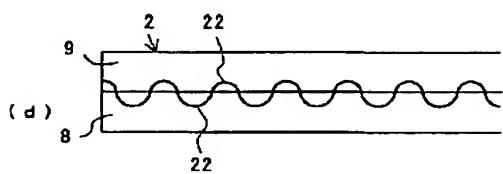
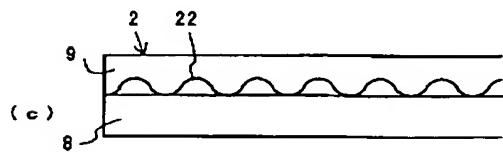
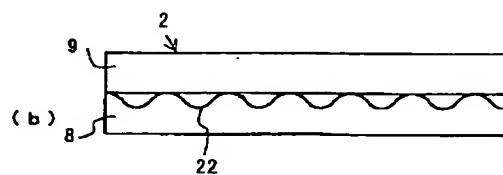
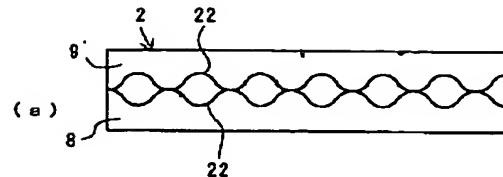
[Drawing 10]



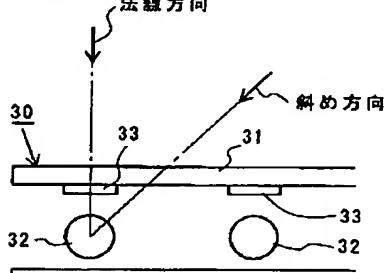
[Drawing 7]



[Drawing 8]



[Drawing 11] 法線方向



[Translation done.]

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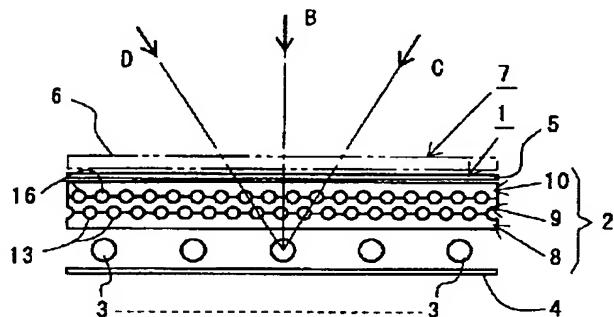
(71)出願人 000208765
株式会社エンプラス
埼玉県川口市並木2丁目30番1号
(72)発明者 大角 和正
埼玉県川口市並木2丁目30番1号 株式会
社エンプラス内
(74)代理人 100107397
弁理士 勝又 弘好
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(54)【発明の名称】拡散部材組立体、面光源装置及び画像表示装置

(57)【要約】

【課題】出射面の法線方向及び斜め方向への照明光を均一化する。

【解決手段】拡散部材組立体2の裏面側に複数の蛍光ランプ3を配置し、蛍光ランプ3の下方に反射部材4を配置し、拡散部材組立体の出射面側(上面側)に拡散シート5を配置してある。拡散部材組立体2は、第1の層8から第3の層10までの3層構造であり、各層を複数の拡散部材プロックで構成してある。各層の重ね合わせ面に断面形状が略円形形状の空孔部13、16をそれぞれ複数形成してあり、空孔部13と空孔部16を半ピッチずらして形成してある。



【特許請求の範囲】

【請求項1】 裏面側に配置した光源からの光を拡散して出射する拡散部材組立体であって、
1以上の拡散部材ブロックからなる第1の層と、この第1の層に重ねられる1以上の拡散部材ブロックからなる第2の層と、を少なくとも有し、
前記第1の層と前記第2の層との重ね合わせ面の少なくとも一方に凹部を多数形成してなることを特徴とする拡散部材組立体。

【請求項2】 裏面側に配置した光源からの光を拡散して出射する拡散部材組立体であって、
1以上の拡散部材ブロックからなる第1の層と、この第1の層に重ねられる1以上の拡散部材ブロックからなる第2の層と、を少なくとも有し、
前記第1の層の前記第2の層に対向する面には第1の凹部を多数形成し、
前記第2の層の前記第1の層に対向する面には前記第1の凹部間に位置するような第2の凹部を多数形成してなることを特徴とする拡散部材組立体。

【請求項3】 前記第1の層を構成する拡散部材ブロックと前記第2の層を構成する拡散部材ブロックとを異なる大きさに形成し、前記第1の層の各拡散部材ブロックの突き合わせ位置と前記第2の層の各拡散部材ブロックの突き合わせ位置とが重ならないようにしてなることを特徴とする請求項1又は2に記載の拡散部材組立体。

【請求項4】 裏面側に配置した光源からの光を拡散して出射する拡散部材組立体であって、
1以上の拡散部材ブロックからなる第1の層と、この第1の層に重ねられる1以上の拡散部材ブロックからなる第2の層と、この第2の層に重ねられる1以上の拡散部材ブロックからなる第3の層を少なくとも有し、
前記第1の層と前記第2の層との重ね合わせ面の少なくとも一方に第1の凹部を多数形成すると共に、前記第2の層と前記第3の層との重ね合わせ面の少なくとも一方に第2の凹部を多数形成し、
前記第2の凹部を前記第1の凹部間に位置するように配置してなることを特徴とする拡散部材組立体。

【請求項5】 裏面側に配置した光源からの光を拡散して出射する拡散部材組立体であって、
1以上の拡散部材ブロックからなる第1の層と、この第1の層に重ねられる1以上の拡散部材ブロックからなる第2の層と、この第2の層に重ねられる1以上の拡散部材ブロックからなる第3の層を少なくとも有し、
前記第1の層の前記第2の層に対向する面には、断面略半円形の第1の凹部を多数形成し、
前記第2の層の前記第1の層に対向する面で、且つ前記第1の凹部に対応する位置には、断面略半円形の第2の凹部を形成し、
前記第2の層の前記第3の層に対向する面には、前記第2の凹部間に位置するように断面略半円形の第3の凹部

を形成し、

前記第3の層の前記第2の層に対向する面で、且つ前記第3の凹部に対応する位置には、断面略半円形の第4の凹部を形成してなることを特徴とする拡散部材組立体。

【請求項6】 前記第1の層を構成する拡散部材ブロックと前記第2の層を構成する拡散部材ブロックとを異なる大きさに形成し、前記第1の層の各拡散部材ブロックの突き合わせ位置と前記第2の層の各拡散部材ブロックの突き合わせ位置とが重ならないようにし、

10 前記第2の層を構成する拡散部材ブロックと前記第3の層を構成する拡散部材ブロックとを異なる大きさに形成し、前記第2の層の各拡散部材ブロックの突き合わせ位置と前記第3の層の各拡散部材ブロックの突き合わせ位置が重ならないようにしてなることを特徴とする請求項4又は5に記載の拡散部材組立体。

【請求項7】 前記光源を棒状の蛍光ランプとし、前記凹部を前記蛍光ランプの長手方向に沿って線状に形成してなることを特徴とする請求項1～6のいずれかに記載の拡散部材組立体。

20 【請求項8】 前記凹部の全てに、前記拡散部材ブロックと異なる屈折率の光透過性物質を充填してなることを特徴とする請求項1～7のいずれかに記載の拡散部材組立体。

【請求項9】 前記多数の凹部の一部に、前記拡散部材ブロックと異なる屈折率の光透過性物質を充填してなることを特徴とする請求項1～7のいずれかに記載の拡散部材組立体。

30 【請求項10】 前記請求項1～9のいずれかに記載の拡散部材組立体と、この拡散部材組立体の裏面側に位置して、前記光源からの光を前記拡散部材組立体の裏面側に反射する反射部材と、を備えたことを特徴とする面光源装置。

【請求項11】 前記拡散部材組立体の出射面側に少なくとも一枚の拡散シートを配置してなることを特徴とする請求項10に記載の面光源装置。

【請求項12】 請求項10又は11に記載の面光源装置と、この面光源装置によって照明される画像表示部と、を備えたことを特徴とする画像表示装置。

【発明の詳細な説明】

40 【0001】

【発明の属する技術分野】この発明は、液晶テレビ、液晶モニター、カーナビゲーション装置、広告表示装置等の各種画像表示装置、及びこれらの液晶表示パネル等の画像表示部をその裏面側から面状に照明する面光源装置に関し、特に、この面光源装置を構成する拡散部材組立体の背面側に光源を配置する技術に関するものである。

【0002】

【従来の技術】例えば、図11に示すような、液晶モニターの液晶表示パネルを裏面側から照明する面光源装置50は、拡散板31の裏面側に複数の蛍光ランプ32を

配置し、この蛍光ランプ32からの光を拡散板31で拡散して面状の照明光として出射するようになっている。

【0003】しかし、このような面光源装置30は、蛍光ランプ32の直上で最も明るく、蛍光ランプ32、32の中間部分が最も暗くなり、拡散板31から面状に出射される光に明暗（輝度むら）が生じるという問題を有していた。

【0004】そこで、従来は、蛍光ランプ32からの光をなるべく均一化して拡散板31から出射させるため、拡散板31の裏面側で且つ蛍光ランプ32に対向する部位に遮光膜（遮光バターン）33を形成し、蛍光ランプ32の直上部分からの出射光を抑え、蛍光ランプ32、32間からの光の出射を促すようになっていた。

【0005】

【発明が解決しようとする課題】しかしながら、このような従来の面光源装置30は、拡散板31の出射面の法線方向への出射光の輝度を均一化することができるものの、拡散板31の出射面の法線方向に対して斜めの方向から見た場合、観察位置と蛍光ランプ32との間には遮光膜33が位置せず、蛍光ランプ32からの光が遮光膜33で遮光されずに拡散板31から出射する。その結果、拡散板31の出射面の法線方向に対して斜めの方向から見た場合には、出射光の明暗の差が強調されて照明品質が低下するという問題を有していた。

【0006】そこで、本発明は、出射面の法線方向及び斜め方向への照明光を均一化することができる拡散部材組立体、この拡散部材組立体を備えた面光源装置、及びこの面光源装置を備えた画像表示装置を提供することを目的とする。

【0007】

【課題を解決するための手段】請求項1の発明は、裏面側に配置した光源からの光を拡散して出射する拡散部材組立体であって、1以上の拡散部材ブロックからなる第1の層と、この第1の層に重ねられる1以上の拡散部材ブロックからなる第2の層と、を少なくとも有し、前記第1の層と前記第2の層との重ね合わせ面の少なくとも一方に凹部を多数形成することを特徴としている。

【0008】請求項2の発明は、裏面側に配置した光源からの光を拡散して出射する拡散部材組立体であって、1以上の拡散部材ブロックからなる第1の層と、この第1の層に重ねられる1以上の拡散部材ブロックからなる第2の層と、を少なくとも有し、前記第1の層の前記第2の層に対向する面には第1の凹部を多数形成し、前記第2の層の前記第1の層に対向する面には前記第1の凹部間に位置するような第2の凹部を多数形成してなることを特徴としている。

【0009】請求項3の発明は、請求項1又は2の発明において、前記第1の層を構成する拡散部材ブロックと前記第2の層を構成する拡散部材ブロックとを異なる大きさに形成し、前記第1の層の各拡散部材ブロックの突き合わせ位置と前記第2の層の各拡散部材ブロックの突き合わせ位置とが重ならないようにしてなることを特徴としている。

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き合わせ位置と前記第2の層の各拡散部材ブロックの突き合わせ位置とが重ならないようにしてなることを特徴としている。

【0010】請求項4の発明は、裏面側に配置した光源からの光を拡散して出射する拡散部材組立体であって、1以上の拡散部材ブロックからなる第1の層と、この第1の層に重ねられる1以上の拡散部材ブロックからなる第2の層と、この第2の層に重ねられる1以上の拡散部材ブロックからなる第3の層を少なくとも有し、前記第1の層と前記第2の層との重ね合わせ面の少なくとも一方に第1の凹部を多数形成すると共に、前記第2の層と前記第3の層との重ね合わせ面の少なくとも一方に第2の凹部を多数形成し、前記第2の凹部を前記第1の凹部間に位置するように配置してなることを特徴としている。

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【0011】請求項5の発明は、裏面側に配置した光源からの光を拡散して出射する拡散部材組立体であって、1以上の拡散部材ブロックからなる第1の層と、この第1の層に重ねられる1以上の拡散部材ブロックからなる第2の層と、この第2の層に重ねられる1以上の拡散部材ブロックからなる第3の層を少なくとも有している。そして、前記第1の層の前記第2の層に対向する面には、断面略半円形の第1の凹部を多数形成してある。また、前記第2の層の前記第1の層に対向する面で、且つ前記第1の凹部に対応する位置には、断面略半円形の第2の凹部を形成してある。また、前記第2の層の前記第3の層に対向する面には、前記第2の凹部間に位置するよう断面略半円形の第3の凹部を形成してある。そして、前記第3の層の前記第2の層に対向する面で、且つ前記第3の凹部に対応する位置には、断面略半円形の第4の凹部を形成してある。

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【0012】請求項6の発明は、請求項4又は5の発明において、前記第1の層を構成する拡散部材ブロックと前記第2の層を構成する拡散部材ブロックとを異なる大きさに形成し、前記第1の層の各拡散部材ブロックの突き合わせ位置と前記第2の層の各拡散部材ブロックの突き合わせ位置とが重ならないようにしてある。また、本発明は、前記第2の層を構成する拡散部材ブロックと前記第3の層を構成する拡散部材ブロックとを異なる大きさに形成し、前記第2の層の各拡散部材ブロックの突き合わせ位置と前記第3の層の各拡散部材ブロックの突き合わせ位置が重ならないようにしてある。

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【0013】請求項7の発明は、請求項1～6のいずれかの拡散部材組立体において、前記光源を棒状の蛍光ランプとし、前記凹部を前記蛍光ランプの長手方向に沿って線状に形成してなることを特徴としている。

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【0014】請求項8の発明は、請求項1～7のいずれかの拡散部材組立体において、前記凹部の全てに、前記拡散部材ブロックと異なる屈折率の光透過性物質を充填してなることを特徴としている。

【0015】請求項9の発明は、請求項1～7のいずれかの拡散部材組立体において、前記多数の凹部の一部に、前記拡散部材ブロックと異なる屈折率の光透過性物質を充填してなることを特徴としている。

【0016】請求項10の発明に係る面光源装置は、請求項1～9のいずれかに記載の拡散部材組立体と、この拡散部材組立体の裏面側に位置して、前記光源からの光を前記拡散部材組立体の裏面側に反射する反射部材と、を備えたことを特徴としている。

〔0017〕請求項11の発明は、請求項10に係る面光源装置において、前記拡散部材組立体の出射面側に少なくとも一枚の拡散シートを配置してなることを特徴としている。

【0018】請求項12の発明に係る画像表示装置は、請求項10又は11に記載の面光源装置と、この面光源装置によって照明される画像表示部と、を備えたことを特徴としている。

[0 0 1 9]

【発明の実施の形態】以下、本発明の実施の形態を図面に基づき詳述する。

【0020】[第1の実施の形態] 図1は、本発明の実施の形態に係る面光源装置の外観斜視図である。また、図2は、図1の面光源装置の分解斜視図である。また、図4は、図1のA-A線に沿って切断して示す断面図である。

〔0021〕(面光源装置及び画像表示装置の概略構成)これらの図に示すように、本実施の形態に係る面光源装置1は、拡散部材組立体2の裏面側(図1、図2及び図4の下面側)に複数の棒状の蛍光ランプ(光源)3を所定の間隔で配置してあり、それらの蛍光ランプ3の下方側に反射部材4を配置してある。この反射部材4は、蛍光ランプ3からの光を拡散部材組立体2の裏面側に反射するようになっている。そして、拡散部材組立体2の出射面側(上方側)には拡散シート5を配置して、拡散部材組立体2から出射した光をその拡散シート5で拡散するようになっている。なお、図4に示すように、面光源装置1の拡散シート5の上に液晶表示パネル(画像表示部)6を重ねて配置することにより、その液晶表示パネル6を面光源装置1から出射した面状の光で照明する画像表示装置7が構成されるようになっている。

【0022】(拡散部材組立体) 拡散部材組立体は、第1の層8から第3の層10までの3層構造である。このうち、第1の層8は、図3に示すように、四角形の板状体である6個の拡散部材ブロック8a～8fを組み合わせることにより、液晶表示パネル6の平面形状に対応するような四角板状に形成してある。すなわち、第1の層8は、拡散部材ブロック8a～8fを縦に2個並べ且つ横に3個並べ(2行3列の合計6個並べ)、各拡散部材ブロック8a～8fの側面を密接させることにより四角板状に形成してある。

【0023】また、第2の層9は、図3に示すように、四角形の板状体である15個の拡散部材ブロック9a～9oを組み合わせることにより、液晶表示パネル6の平面形状に対応するような四角板状に形成してある。すなわち、第2の層9は、拡散部材ブロック9a～9oを縦に3個並べ且つ横に5個並べ（3行5列の合計15個並べ）、各拡散部材ブロック9a～9oの側面を密接させることにより四角板状に形成してある。そして、この第2の層9の各拡散部材ブロック9a～9oの突き合わせ位置は、第1の層8の各拡散部材ブロック8a～8fの突き合わせ位置に重ならないようになっている。

【0024】また、第3の層10は、四角形の板状体である2個の拡散部材ブロック10a、10bを組み合わせることにより、液晶表示パネル6の平面形状に対応するような四角板状に形成してある。すなわち、第3の層10は、拡散部材ブロック10a、10bを横に2個並べ、両拡散部材ブロック10a、10bの側面を密接させることにより四角板状に形成してある。そして、この第3の層10の両拡散部材ブロック10a、10bの突き合わせ位置は、第2の層9の各拡散部材ブロック9a～9dの突き合わせ位置に重ならないようになっている。

【0025】ここで、第1の層8から第3の層10までの各層の各拡散部材ブロック8a～8f, 9a～9o, 10a～10bは、光透過性に優れたアクリル樹脂(PMMA)やポリカーボネート(PC)、シクロオレフィン系樹脂等を射出成形することにより、所望の形状に形成してある。

【0026】図5は、図4に示す拡散部材組立体2の部分的拡大図である。また、図6は、図5に示す拡散部材組立体2を第1の層8から第3の層10までの各層に分解して示す部分的拡大図である。

【0027】これらの図に示すように、第1の層8の拡散部材ブロック8a～8fの第2の層9の拡散部材ブロック9a～9oに対向する面には、断面略半円形状の第1の凹部11を等間隔で多数形成してある。また、第2の層9の拡散部材ブロック9a～9oの第1の層8の拡散部材ブロック8a～8fに対向する面には、第1の層8の第1の凹部11に対向する断面略半円形の第2の凹部12を等間隔で多数形成してある。その結果、第1の層8の拡散部材ブロック8a～8fと第2の層9の拡散部材ブロック9a～9oとを重ねて密着させると、第1の凹部11と第2の凹部12とによって断面略円形の空孔部13が形成されるようになっている。

【0028】第2の層9の拡散部材ブロック9a～9oの第3の層10の拡散部材ブロック10a, 10bに対向する面には、断面略半円形の第3の凹部14を前記第2の凹部12間に位置するように且つ第2の凹部12の形成ピッチと同一のピッチPで多数形成してある。また、第3の層10の拡散部材ブロック10a, 10bの

第2の層9の拡散部材ブロック9a～9oに対向する面には、第2の層9の第3の凹部14に対向する断面略半円形の第4の凹部15を等間隔で多数形成してある。その結果、第2の層9の拡散部材ブロック9a～9oと第3の層10の拡散部材ブロック10a, 10bとを重ねて密着させると、第3の凹部14と第4の凹部15によって断面略円形の空孔部16が形成されるようになっている。なお、各凹部11, 12, 14, 15間のピッチPは、凹部11, 12, 14, 15の半径をRとするとき、 $2R \leq P \leq 4R$ の範囲で決定することが好ましい。

【0029】ここで、拡散部材組立体2の上方から(図4のB方向から)見た場合や、斜め方向(図4のC, D方向)から見た場合、第1の層8と第2の層9の重ね合わせ面にできる空孔部13間に、第2の層9と第3の層10の重ね合わせ面にできる空孔部16が位置するようになっている(換言すれば、空孔部16が空孔部13に対して半ピッチずれている)。そして、この拡散部材組立体2は、空孔部13, 16内に空気が存在しており、拡散部材ブロック(8a～10b)と空孔部13, 16とで光の屈折率が大きく異なる(例えば、PMMAの屈折率が約1.49であり、PCの屈折率が1.59である)とともに、空孔部13, 16の断面形状が略円形であるため、蛍光ランプ3からの光が拡散部材組立体2を透過する際に空孔部13, 16で効果的に拡散される。すなわち、上方(図4のB方向)から拡散部材組立体2を見た場合はもちろんのこと、斜め上方(図4のC, D方向)から見た場合においても、蛍光ランプ3からの光が空孔部13, 16で均一に拡散されているため、出射光の輝度が均一化し、出射光の明暗の差が生じにくい。

【0030】なお、本実施の形態において、各層の隣り合う拡散部材ブロック(8a～8f, 9a～9o, 10a～10b)同士を接着して一体化する場合には、拡散部材ブロック(8a～10b)と屈折率がほぼ同様の接着剤(例えば、エポキシ樹脂系接着剤)を使用することが望ましい。

【0031】(反射部材)反射部材4は、図1～図2及び図4に示すように、光反射性に優れた白色のポリエチレンテレフタレート(PET)等の樹脂材料、又はステンレス鋼板等の金属板の内面に銀の蒸着層を形成したもの等で形成してあり、蛍光ランプ3からの光を導光板組立体2の裏面側に効果的に反射するようになっている。

【0032】(拡散シート)拡散シート5は、図1～図2及び図4に示すように、光透過性に優れたPETシート等の表面を粗面化したり、また、その表面に光拡散性を有するインクで光拡散バターンを形成したり、また、その内部に光拡散物質を含有させて、拡散部材組立体2から出射する光を効果的に拡散する。その結果、拡散シート5の出射面方向から面光源装置1を見た場合、第1の層8から第3の層10までの各層の拡散部材ブロック

(8a～8f, 9a～9o, 10a～10b)の突き合わせ部(第1の層8から第3の層10までの分割部)が目立ちにくくなる。

【0033】(本実施の形態の作用・効果)以上のような本実施の形態に係る面光源装置1は、蛍光ランプ3の光が直接又は反射部材4によって反射されて拡散部材組立体2の第1の層8の拡散部材ブロック8a～8f下面から入射すると、その入射光が第1の層8の拡散部材ブロック8a～8f内を伝播する過程において第1の層8と第2の層9の重ね合わせ面に形成された凹部11, 12(空孔部13)との界面で屈折作用を受ける。ここで、その空孔部13の断面形状が略円形形状であり、しかも空孔部13の内部に空気が存在し、空孔部13の内部と第1及び第2の層8, 9の拡散部材ブロック8a～9oとの光の屈折率が大きく相違するため、第1の層8の拡散部材ブロック8a～8f内を伝播する光が均一に拡散される。

【0034】そして、上述の第1の層8と第2の層9の重ね合わせ面に形成した空孔部13で拡散されない光及び拡散された光が第2の層9の拡散部材ブロック9a～9o内を伝播すると、第2の層9と第3の層10の重ね合わせ面に形成された凹部14, 15(空孔部16)との界面で屈折作用を受ける。ここで、この第2の層9と第3の層10の重ね合わせ面に形成した空孔部16は、上述の第1の層8と第2の層9との間に形成した空孔部13と同様であるため、第2の層9内を伝播する光がその空孔部16で均一に拡散される。すなわち、第2の層9と第3の層10との重ね合わせ面に形成した空孔部16は、第1の層8と第2の層9の重ね合わせ面に形成した空孔部13で拡散できなかった光を拡散することができる。尚、図10に空孔部13, 16との界面で屈折作用を受け拡散する光の代表的な光路を概念的に示す。

【0035】したがって、拡散部材組立体2からの出射光は、出射面の法線方向(図4のB方向)はもちろんのこと、法線方向に対して斜めの方向(図4のC, D方向)においても均一化する。すなわち、本実施の形態の面光源装置1において、拡散部材組立体2からの出射光は、観察方向によって輝度むらが生じるようにならぬ、照明品質が向上する。

【0036】そして、拡散部材組立体2から出射した光は、拡散シート5を通過し、液晶表示パネル6の照明光として利用される。ここで、各層の隣り合う拡散部材ブロックを十分に密着させることができず、その境界に沿って光学的な界面が存在するとスジ状の輝線が発生してしまう等の異常発光が観察されることがあるが、第1の層8の各拡散部材ブロック8a～8fの突き合わせ部で生じる異常発光が第2の層9, 第3の層10及び拡散シート5で拡散され、第2の層9の各拡散部材ブロック9a～9oの突き合わせ部で生じる異常発光が第3の層10及び拡散シート5で拡散され、第3の層10の拡散部

材ブロック10a, 10b同士の突き合わせ部で生じる異常発光が拡散シート5で拡散され、各拡散部材ブロック8a・・・10bの突き合わせ部で生じる異常発光が目立たなくなる。その結果、本実施の形態に係る面光源装置1は、液晶表示パネル6を明るく均一な光で照明でき、液晶表示パネル6の表示が見やすくなる。

【0037】また、本実施の形態に係る面光源装置1は、従来例のような遮光膜（遮光パターン）を形成する必要がないため、遮光膜で光が吸収されるようにならぬ、出射光輝度を高めることができる。

【0038】また、本実施の形態に係る面光源装置1は、拡散部材組立体2を第1～第3の層8～10に多層化し、各層8～10を複数の拡散部材ブロック8a～8f, 9a～9o, 10a～10bに分割して構成してあるため、小さな拡散部材ブロック8a・・・10bの組み合わせ個数を多くすることにより、拡散部材組立体2の出射光面積を容易に大きくすることができる。したがって、本実施の形態によれば、拡散部材ブロック8a・・・10bを射出成形するための金型が小さくてすむと共に、液晶表示パネル6の大きさ（表示画面の大きさ）に関わらず拡散部材ブロック8a・・・10bの射出成形用金型を共用できるため、製造設備の大型化をすることなく、大型画面用の面光源装置1を容易に製造することができる。

【0039】また、本実施の形態に係る面光源装置1は、拡散部材組立体2の空孔部13, 16内が空気層であるため、全体重量の軽量化を図ることができる。

【0040】また、本実施の形態に係る拡散部材組立体2は、各層8～10が複数の拡散部材ブロック8a・・・10bに分割されており、各拡散部材ブロック8a・・・10bが小さくて射出成形し易いため、成形不良が生じにくく、製品の歩留り率がよい。

【0041】【第2の実施の形態】図7は、本発明の第2の実施の形態に係る拡散部材組立体2の一部を拡大して示す側面図である。

【0042】本実施の形態は、図7に示すように、断面略半円形の第1の凹部20を第1の層8と第2の層9との重ね合わせ面のいずれか一方に多数形成し、また、断面略半円形の第2の凹部21を第2の層9と第3の層10との重ね合わせ面のいずれか一方に多数形成するものである。なお、第1の層8から第3の層10の各層は、前述の第1の実施の形態と同様に複数の拡散部材ブロック8a・・・10bを組み合わせて構成されるようになっている（図3参照）。

【0043】すなわち、本実施の形態の第1例は、図7(a)に示すように、第1の凹部20を第1の層8の第2の層9に対向する面に形成し、また、第2の凹部21を第3の層10の第2の層9に対向する面に形成するようになっており、しかも、第2の凹部21が第1の凹部20, 20の間に位置するようになっている（換言すれ

ば、第2の凹部21が第1の凹部20に対して半ピッチずれている）。

【0044】また、本実施の形態の第2例は、図7(b)に示すように、第1の凹部20を第2の層9の第1の層8に対向する面に形成し、また、第2の凹部21を第2の層9の第3の層10に対向する面に形成するようになっており、しかも、第2の凹部21が第1の凹部20, 20の間に位置するようになっている。

【0045】また、本実施の形態の第3例は、図7(c)に示すように、第1の凹部20を第2の層9の第1の層8に対向する面に形成し、また、第2の凹部21を第3の層10の第2の層9に対向する面に形成するようになっており、しかも、第2の凹部21が第1の凹部20, 20の間に位置するようになっている。

【0046】また、本実施の形態の第4例は、図7(d)に示すように、第1の凹部20を第1の層8の第2の層9に対向する面に形成し、また、第2の凹部21を第2の層9の第3の層10に対向する面に形成するようになっており、しかも、第2の凹部21が第1の凹部20, 20の間に位置するようになっている。

【0047】このような構成の本実施の形態においても、蛍光ランプ3からの光を各凹部20, 21によって拡散することができ、拡散部材組立体2の出射面から光を均一に出射することができるため、観察方向による出射光の輝度むらの発生を効果的に防止できる。

【0048】また、本実施の形態においても、前述の第1の実施の形態と同様の効果を得ることができる。

【0049】【第3の実施の形態】図8は、本発明の第3の実施の形態に係る拡散部材組立体2の一部を拡大して示す側面図である。

【0050】本実施の形態は、拡散部材組立体2を第1の層8と第2の層9で構成し、これら第1の層8と第2の層9の重ね合わせ面の少なくとも一方に凹部22を多数形成するようになっている。なお、本実施の形態の第1の層8及び第2の層9は、前述の各実施の形態と同様に複数の拡散部材ブロック8a～8f, 9a～9oを組み合わせて構成されるようになっている。

【0051】すなわち、本実施の形態の第1例は、図8(a)に示すように、第1の層8と第2の層9の重ね合わせ面に凹部22, 22を対向させて形成するようになっている。また、第2例は、図8(b)に示すように、第1の層8の第2の層9に対向する面に凹部22を多数形成するようになっている。また、第3例は、図8

(c)に示すように、第2の層9の第1の層8に対向する面に凹部22を多数形成するようになっている。なお、これら第1～第3例の凹部22は、滑らかな曲線で連続的に形成されており、隣り合う凹部22, 22同士も滑らかな曲線で接続されるようになっている。そのため、凹部22を形成する面の断面形状が略波形形状を呈している。

【0052】また、第4例は、図8(d)に示すように、第1の層8と第2の層9の各重ね合わせ面にそれぞれ断面略半円形の凹部22, 22を多数形成するようになっており、第1の層8の凹部22, 22間に第2の層9の凹部22が位置するようになっている。

【0053】このような本実施の形態に係る拡散部材組立体2も、蛍光ランプからの光を凹部22で拡散することができ、観察方向による輝度むらの発生を効果的に防止することができる。

【0054】なお、本実施の形態に係る拡散部材組立体2は、層の数が少ないため、面光源装置1及びこの面光源装置1を備えた画像表示装置7の薄型化・軽量化を図ることができる。

【0055】【その他の変形例】上述の各実施の形態は、凹部11～12, 14～15, 20～22内に空気が存在する態様を例示しているが、これに限らず、凹部11～12, 14～15, 20～22内に拡散部材ブロック8a～10bの屈折率と異なる屈折率の光透過性物質を充填するようにしてもよい。また、凹部11～12, 14～15, 20～22に充填する光透過性物質は、拡散部材ブロック8a～10bと同種又は異種の材料にこれと異なる屈折率を有する微小粒子を混入分散させたものであってもよい。なお、光透過性物質は、凹部11～12, 14～15, 20～22の全てに充填してもよく、また、その一部に充填するようにしてもよい。

【0056】また、上述の各実施の形態において、略半円形又は滑らかな曲線で連続的に形成された断面形状の凹部11～12, 14～15, 20～22を例示したが、これに限らず、光を拡散できる断面形状の凹部であればよく、断面略三角形の凹部やその他の断面形状の凹部でもよい。

【0057】また、上述の各実施の形態は、拡散部材組立体2を3層又は2層で構成する態様を例示しているが、これに限らず、拡散部材組立体2を4層以上の多層構造体にしてもよい。

【0058】また、上述の各実施の形態は、図9に示すように、凹部11～12, 14～15, 20～22を蛍光ランプの長手方向に沿って線状に形成する態様を例示するものであるが、これに限らず、例えば、凹部をドット状に多数形成する態様にしてもよい。

【0059】また、上述の各実施の形態では凹部(空孔部)の形成ピッチを一定のものとしているが、裏面側に配置する光源との相対的な位置に応じて、その形成ピッチの粗密を変化させるようにしてもよい。

【0060】

【発明の効果】以上のように、本発明は、裏面側に配置した光源からの光を拡散して出射する拡散部材組立体が

多層構造体であり、各層の重ね合わせ面の少なくとも一方に形成した凹部で光を均一に拡散できるようになっているため、観察方向によって輝度むらが生じるのを効果的に抑えることができ、出射面の法線方向はもちろんのこと、出射面の法線方向に対して斜めの方向への出射光の輝度分布も均一化することができ、照明品質の向上を図ることができる。

【0061】また、本発明は、拡散部材組立体の各層の重ね合わせ面の少なくとも一方に形成した凹部が光を拡散するため、従来例のような遮光パターンを拡散部材に形成する必要がなく、少なくとも遮光パターンによる光の吸収が無い分だけ出射光輝度を高めることができる。

【0062】したがって、本発明に係る拡散部材組立体を備えた面光源装置は、画像表示部を照明する照明光が均一化すると共に高輝度化する。その結果、このような面光源装置を備えた画像表示装置は、画像表示部による表示画像が明るくて見やすくなる。

【図面の簡単な説明】

【図1】本発明の第1の実施の形態に係る面光源装置の外観斜視図である。

【図2】図1の面光源装置を分解して示す斜視図である。

【図3】本発明の第1の実施の形態に係る拡散部材組立体を分解して示す平面図である。

【図4】図1のA-A線に沿って切断して示す断面図である。

【図5】図4に示す拡散部材組立体の部分的拡大図である。

【図6】図5に示す拡散部材組立体を分解して示す部分的拡大図である。

【図7】本発明の第2の実施の形態に係る拡散部材組立体の部分的拡大図である。

【図8】本発明の第3の実施の形態に係る拡散部材組立体の部分的拡大図である。

【図9】拡散部材組立体の各層に形成する凹部の形状を示す斜視図である。

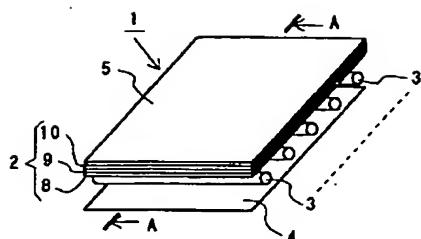
【図10】空孔部との界面で屈折作用を受けて拡散する光の代表的な光路を概念的に示す図である。

【図11】従来の面光源装置の一部を拡大して示す側面図である。

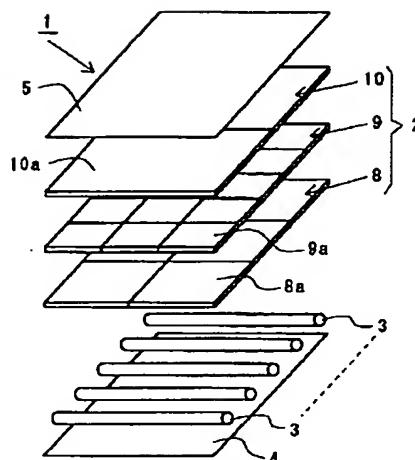
【符号の説明】

1……面光源装置、2……拡散部材組立体、3……蛍光ランプ(光源)、4……反射部材、5……拡散シート、6……液晶表示パネル(画像表示部)、7……画像表示装置、8……第1の層、9……第2の層、10……第3の層、8a～8f, 9a～9o, 10a～10b……拡散部材ブロック、11, 12, 14, 15, 20, 21, 22……凹部

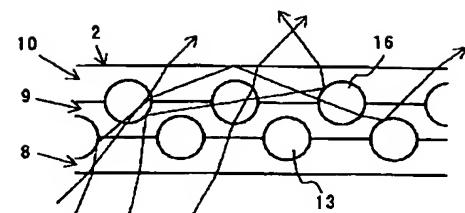
【図1】



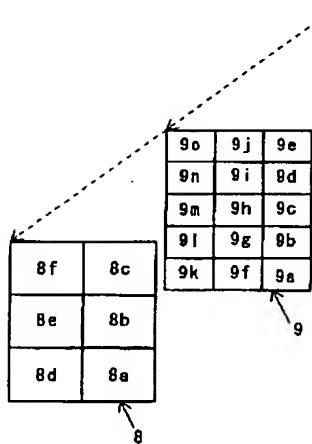
【図2】



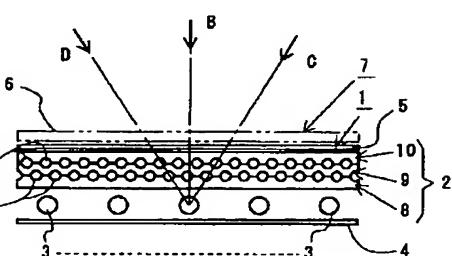
【図10】



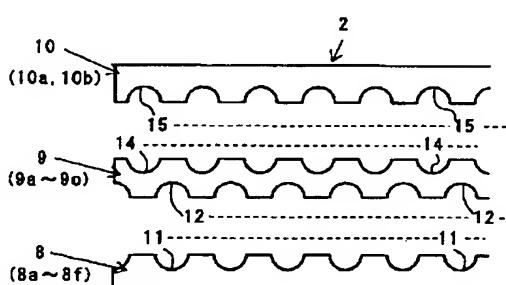
【図3】



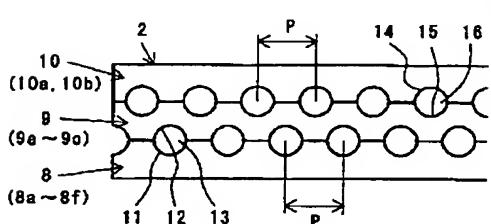
【図4】



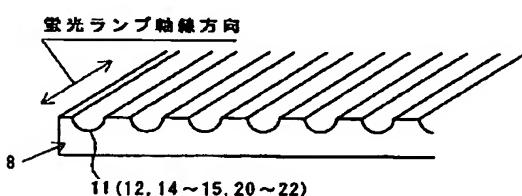
【図6】



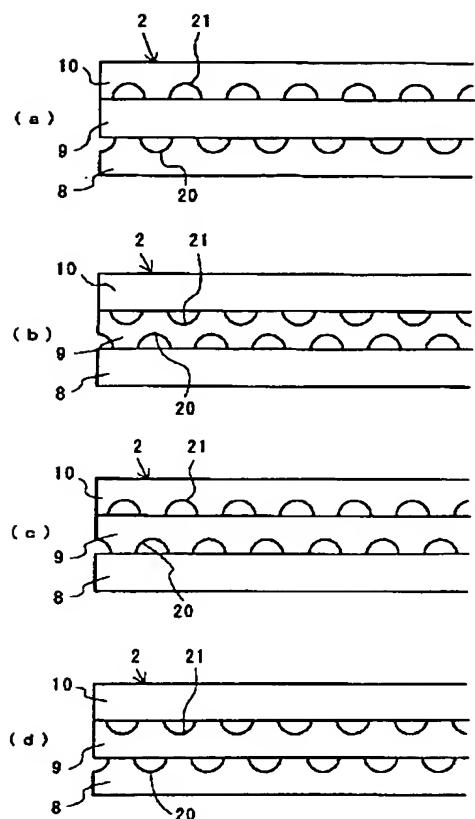
【図5】



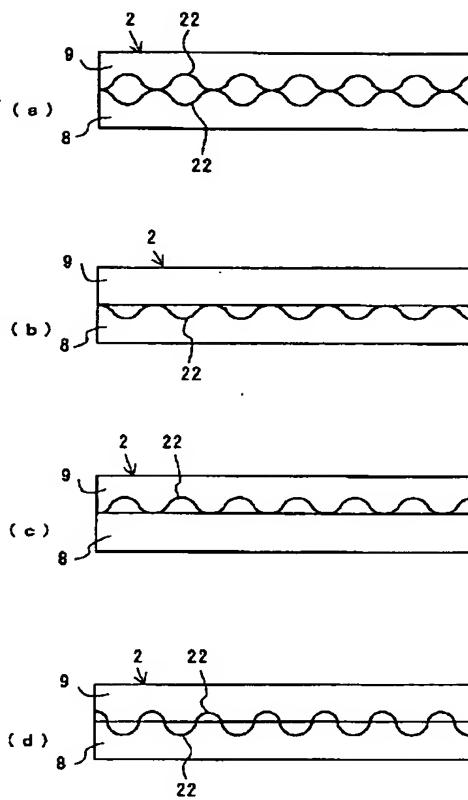
【図9】



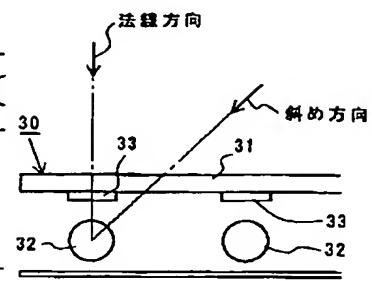
【図7】



【図8】



【図11】



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